What is claimed is:

1. A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating said charged particle beam converged by said charged particle optical system to said sample in order to scan said sample;

a focal point control system for controlling a focal point of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a 2 dimensional particle image by detection of a particle image generated by said sample scanned by radiation of said charged particle beam converged by said charged particle optical system;

an image processing means for computing a focal offset and said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle image obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment.

2. A charged particle beam apparatus according to claim 1, wherein said control system for adjusting and controlling further provides adjusting and controlling of said focal point of said converged charged particle beam by feeding back a focal point correction quantity based on said focal offset computed by said image processing means to said focal point control system.

3. A charged particle beam apparatus according to claim 1, wherein said charged particle beam apparatus creates a pattern, said pattern including edge components in at least 3 directions on said sample.

4. A charged particle beam apparatus according to claim 3, wherein said charged particle beam apparatus creates said pattern including edge components in at

least 3 directions, said pattern having at least 3 areas, each of said areas for creating a sub pattern having one of said edge components in one of said directions on said sample.

5. A charged particle beam apparatus according claim 1, wherein said astigmatism in said image processing means is any selected from a magnitude and a direction of said astigmatism and a vector of said astigmatism.

6. A charged particle beam apparatus according to claim 1, wherein said particle image detection means detects a particle image generated from said sample serving as an object substrate as a result of radiation of said converged charged particle beam with at least said astigmatism adjusted and controlled by said control system to said object substrate in a scanning operation carried out by using said scanning means; and

a defect inspection image processing means is provided for inspecting said object substrate for a defect existing on said object substrate on the basis of said detected particle image.

7. A charged particle beam apparatus according to claim 6, wherein control of said focal point control system is based on a height on said object substrate optically detected by a height detection sensor further provided for optically detecting a height on said object substrate.

8. A charged particle beam apparatus according to claim 1, wherein said particle image detection means detects a particle image generated from said sample serving as an object substrate as a result of radiation of said converged charged particle beam with at least said astigmatism adjusted and controlled by said control system to said object substrate in a scanning operation carried out by using said scanning means; and

a measurement image processing means is provided for measuring dimensions of a pattern existing on said object substrate on the basis of said detected particle image.

9. A charged particle beam apparatus according to claim 8, wherein control of said focal point control system is based on a height on said object substrate optically detected by a height detection sensor further provided for optically detecting a height on said object substrate.

10. A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for radiating said charged particle beam converged by said charged particle optical system to said sample in order to scan said sample;

a focal point control system for controlling a focal point of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a 2 dimensional particle image having a plurality of focal point positions by detection of a particle image with a plurality of focal point positions generated by said sample scanned by radiation of said charged particle beam converged by said charged particle optical system;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle image with a plurality of focal point positions obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means.

11. A charged particle beam apparatus according to claim 10, wherein said control system for adjusting and controlling further provides adjusting and controlling of said focal point of said converged charged particle beam by feeding back a focal point correction quantity based on said focal offset computed by said image processing means to said focal point control system.

12. A charged particle beam apparatus according to claim 10, wherein said image processing means computes said astigmatism of said converged charged particle beam from a relation among in focus positions at directional sharpness magnitudes for at least 3 directions by finding said directional sharpness magnitudes for at least said 3 directions for a plurality of focal point positions from said 2 dimensional particle image with a plurality of focal point positions obtained by said particle image

detection means and then finding said in focus positions at said found directional sharpness magnitudes for at least said 3 directions.

13. A charged particle beam apparatus according to claim 12, wherein said control system for adjusting and controlling further provides adjusting and controlling of said focal point of said converged charged particle beam by feeding back a focal point correction quantity based on said focal offset computed by said image processing means to said focal point control system.

14. A charged particle beam apparatus according to claim 12, wherein said image processing means has a configuration wherein directional sharpness magnitudes in at least 3 directions are found by carrying out directional differentiation processing in at least 3 directions.

15. A charged particle beam apparatus according to claim 12, wherein said image processing means has a configuration wherein directional sharpness magnitudes in at least 3 directions are found by computing amplitudes of a particle image in at least 3 directions.

16. A charged particle beam apparatus according to claim 12, wherein said image processing means has a configuration wherein directional sharpness magnitudes in at least 3 directions are found by texture strengths for pattern components in at least 3 directions from a Fourier spectrum of a particle image.

17. A charged particle beam apparatus according to claim 10, wherein said particle image detection means has a configuration wherein a particle image having a plurality of different focal point positions is detected from said sample by controlling said focal point control means.

18. A charged particle beam apparatus according to claim 10, said charged particle beam apparatus characterized in that said particle image detection means has a configuration wherein a particle image having a plurality of different focal point positions is detected from a plurality of different areas on said sample.

19. A charged particle beam apparatus according to claim 18, wherein said sample is inclined or has a staircase like surface.

20. A charged particle beam apparatus according to claim 18, wherein said converged charged particle beam is radiated to said sample and scanned over said sample by changing said focal point position at a high speed.

21. A charged particle beam apparatus according claim 12, wherein said image processing means determines said in focus position for each of said directional sharpness magnitudes by:

finding a maximum value for each of said directional sharpness magnitudes;

applying a function having a peak such as a quadratic function or a Gaussian function by using values preceding and succeeding said maximum value;

finding a true peak value by interpolation; and

using the position of said true peak value as said in focus position.

22. A charged particle beam apparatus according to claim 21, wherein, if a plurality of maximum values exist for each of said directional sharpness magnitudes, a weighted average of peak positions of said maximum values with weights thereof set in accordance with heights at said peak positions is found as an in focus position.

23. A charged particle beam apparatus according to claim 12, wherein said image processing means determines an in focus position for each of directional sharpness magnitudes as a center of gravity of an area enclosed by a segment of a curve and a horizontal line representing a threshold value where said curve represents variations of each of said directional sharpness magnitudes with respect to said in focus position whereas said segment represents said variations exceeding said threshold value.

24. A charged particle beam apparatus according claim 12, wherein said image processing means determines said in focus position for each of directional sharpness magnitudes by:

computing a degree of matching between a curve representing variations of an evaluation value with respect to each of said directional sharpness magnitudes and any one of curves of image inversion which are each symmetrical with respect to an axis of symmetry on the right and left sides of said axis of symmetry;

determining a specific one of said curves of image inversion with a highest degree of matching; and

using the position of an axis of symmetry of said specific curve of image inversion as said in focus position.

25. A charged particle beam apparatus according to claim 12, said charged particle beam apparatus further comprising:

a standard sample is provided for calibration purposes at a location adjacent to an object substrate;

at least astigmatism or a focal point is corrected on said standard sample prior to an observation, an inspection or a measurement of said object substrate or periodically; wherein said observation, said inspection or said measurement of said object substrate is carried out in a state of corrected astigmatism or a corrected focal point.

26. An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted by a charged particle source;

radiating said converged charged particle beam to a sample with a pattern created thereon;

obtaining a 2 dimensional particle image by detection of particles generated from said sample by said radiating;

computing a focal offset and astigmatism of said converged charged particle beam based on said 2 dimensional particle image; and

adjusting and controlling said astigmatism of said converged charged particle beam based on a feed back of an astigmatism correction quantity computed based upon said astigmatism; and said focal point of said converged charged particle beam based on a feed back a focal point correction quantity computed based upon said focal offset.

27. An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted by a charged particle source;

radiating said converged charged particle beam to a sample with a pattern created thereon;

changing a focal point of said converged charged particle beam;

obtaining a plurality of 2 dimensional particle images having different focal points of said converged charged particle beam by detection of particles generated from said sample by said radiating;

computing astigmatism of said converged charged particle beam based on said obtained plurality of 2 dimensional particle images; and

adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based upon said astigmatism.

28. An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted by a charged particle source;

radiating said converged charged particle beam to a sample with a pattern created thereon;

obtaining a plurality of 2 dimensional particle images having different focal points of said converged charged particle beam by detection of particles generated from said sample by said radiating;

computing a focal offset and astigmatism of said converged charged particle beam based on said obtained plurality of 2 dimensional particle images; and

adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based upon said astigmatism; and said focal point of said converged charged particle beam by feeding back a focal point correction quantity computed based on said focal offset.

29. An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted by a charged particle source;

radiating said converged charged particle beam to a sample with a pattern created thereon;

obtaining a plurality of 2 dimensional particle images having different focal points of said converged charged particle beam by detection of particles generated from said sample by said radiating;

computing directional sharpness magnitudes for at least 3 directions from said plurality of 2 dimensional particle images;

computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions;

computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions; and

adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based on said astigmatism.

30. The automatic astigmatism adjustment method of claim 29, further comprising:

repeating said converging through said adjusting and controlling until said astigmatism correction quantity is sufficiently small.

31. An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted by a charged particle source;

radiating said converged charged particle beam to a sample with a pattern created thereon;

obtaining a plurality of 2 dimensional particle images having different focal points of said converged particle beam by detection of particles generated from said sample by said radiating;

computing directional sharpness magnitudes for at least 3 directions for a plurality of focal point positions from said plurality of 2 dimensional particle images;

computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions;

computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions; and

controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based on said astigmatism; and said focal point of said converged charged particle beam by feeding back a focal point correction quantity computed based on said in focus positions.

32. An automatic astigmatism adjustment method according to claim 31, wherein said computing in focus position using said computed directional sharpness magnitudes further comprises:

computing a maximum value for each of said directional sharpness magnitudes;

applying a function having a peak such as a quadratic function or a Gaussian function by using values preceding and succeeding said maximum value;

computing a true peak value by interpolation; and

using the position of said true peak value as said in focus position.

33. An automatic astigmatism adjustment method according to claim 32, wherein if a plurality of maximum values exist for each of said directional sharpness magnitudes, a weighted average of peak positions of said maximum values with weights thereof set in accordance with heights at said peak positions is computed as an in focus position.

34. An automatic astigmatism adjustment method according to claim 31, wherein said computing an in focus position using said computed directional sharpness magnitudes further comprises:

computing a center of gravity of an area enclosed by a segment of a curve and a horizontal line representing a threshold value where said curve represents variations of each of said computed directional sharpness magnitudes with respect to said in focus position; and wherein said segment represents said variations exceeding said threshold value.

35. An automatic astigmatism adjustment method according to claim 31, wherein said computing an in focus position using said computed directional sharpness magnitudes further comprises:

computing a degree of matching between a curve representing variations of an evaluation value with respect to each of said directional sharpness magnitudes and any one of curves of image inversion which are each symmetrical with respect to an axis of symmetry on the right and left sides of said axis of symmetry;

determining a specific one of said curves of image inversion with a highest degree of matching; and

using the position of an axis of symmetry of said specific curve of image inversion as said in focus position.